PROTOTYPE DESIGN for GLOBAL SEED BANKS NETWORK

ARCH 523 Masters Project Preparation
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ABOUT THE PROJECT

A simple identifier:
"My project will be a prototype of seed banks."

A short description:
"My project will be about a network of banks/research centers conserving genetic information of plants, researching possibilities of artificial reproduction and climate adjustment."

A pointed case statement:
"My project will be developed because due to climate change a lot of plant species are in danger of extinction. As scientists assume, Arctic ice might totally disappear by 2040, which will, of course,cause the changes in water level and therefore, flood a large part of the Earth. They also assume, that by 2070 the lowest temperature will be the highest temperature any plants have ever experienced. So what happens to plants in such case becomes obvious - they die out; this will cause a chain reaction of fauna extinction, since they will have neither shelter nor food.

My project would be a prototype of seed bank for a global network spread throughout the world. I would like to propose locations for multifunctional centers in certain countries, which would be supplied by sub-centers located in others based on long term climate, political and economic predictions. The prototype building will be a modular structure, allowing each country to select functions and size appropriate to them.

The building will include seed storages and labs, where groups of scientists would register and dry collected seeds, then conserve and reproduce them; they will modify plants genetically to help them adjust to new climate conditions.
The facility will also include functions to help rise public interest and awareness and accommodation for travelling scientists."

PROJECT GOALS

The idea is important because the results of global warming might be much more destructive in long term than a lot of people might realize; once we lose species of live organisms without a trace, we might never get them back. And it is not just the specific species we lose, but the entire chain reaction tied to it.

Since the issue is global, solving something of that scale is connected to large amount of resources of different kinds. Preserving plants by creating genetic banks for later artificial reproduction seems to me like a more realistic option then preserving entire lands.

The project will solve issues of plant species extinction caused by global warming.

The project will be successful by creating not only one or two centers for species preservation, but by designing an entire system, a net of intellect, specialists from different parts of the world fighting for saving the green.

Potential Design Responses:
- Creating a net of genetic centers in different endangered parts of the world.
- Designing a prototype building which could work in different climate conditions with the same success.
- Making the system as much off-grid and sustainable as possible.

CASE STATEMENT

"All human life, all life, depends on plants", - says the head of commissioning of BBC and main-Board Trustee of Millenium Seed Bank Project Johnathan Drori: "It does not matter if you live in a small African village or a big city - everything comes to plants in the end - whether it's for the food, the medicine, the fuel, the construction, the clothing, all the obvious things; or whether it's the spiritual or recreational things that matter to us so much; or whether it's the soil formation or the effects on the atmosphere, or primary produciton. Damn it, even the books here are made out of plants. All these things, they come back to plants. And without them we would not be here.

Now plants are under threat. They are under threat because of the changing climate. And they are also under threat because they are sharing a planet with people like us. And people like us want to do things that destroy plants and their habitats. And whether it is because of the food production or the introduction of alien plants into places where they really oughtn't be, or because of habitats being used for other purposes, all these things are meaning that plants have to adapt, or die, or move. And plants sometimes find it rather difficult to move, because there might be cities or other things on the way.

So if all human life depends on plants, doesn't it makes sense that perhaps we should try to save them?!"

* Source: Drori, Johnathan. Why we're storing billions of seeds. TED Talk. Web. Filmed Feb 2009. Posted May 2009. <http://www.ted.com/talks/jonathan_drori_why_we_re_storing_billions_of_seeds.html?ga_source=embed&ga_medium=embed&ga_campaign=embed>

Climate change in the world has caused extinction of a lot of flora species. According to scientists, by 2070 the lowest temperature on the earth will be the highest plants have ever experienced; therefore, the chances of their survival is really low. Losing plant species will cause various tragic results, including starvation.

Seed banks are institutions created to conserve and preserve plants of the world. Researchers register, study, conserve and genetically modify species of different plants; they want to make sure that the plants are able to survive the climate change and the ones which cannot be modified, are saved until the climate conditions go back to normal.

Because of various political, mechanical or economical reasons seed banks have failed in different countries, which resulted in losing the entire collection. By creating a network of seed banks, I would like to design a system which makes sure there is a backup collection in cases of failure; and later, by designing a prototype seed bank, I would like to propose a standard of the institutions, which can be used in different parts of the network. Modular system will allow the clients to construct the bank of a size appropriate to their needs.

STAKEHOLDERS

STAFF

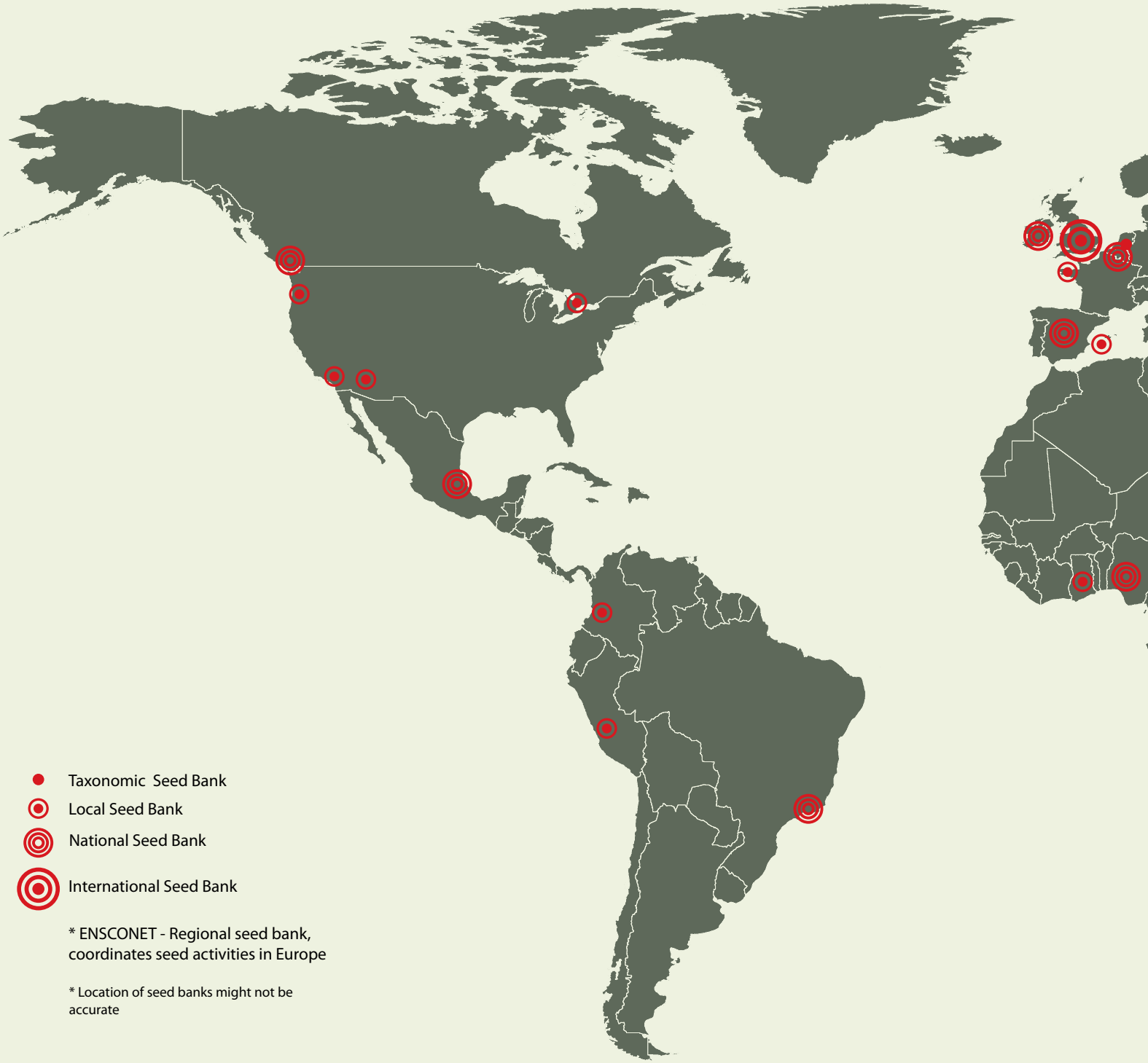
- Researchers and volunteers - to collect, dry and store seeds
- Researchers - to organize and register seeds for archieving
- Researchers - to observe and check seed condition
- Genetic engineers - to modify plants for climate adjustment
- Botanists - to study and take care of the plants in greenhouse
- Mechanical engineers - to observe mechanical systems' performance
- Security - to keep seeds and information safe
- Maintenance - to clean the building

PUBLIC

- Visiting researchers - to take part in international programs; might need a temporary accommodation if the center is far from the city
- Volunteers - to help researchers in seed collection and maintenance
- Visitors - to visit exhibitions
- Visitors - to attend lectures and conferences

CASE STUDIES

DIAGRAM OF EXISTING SEED BANKS



Taxonomic Seed Bank

Local Seed Bank

National Seed Bank

International Seed Bank

* ENSCONET - Regional seed bank, coordinates seed activities in Europe

* Location of seed banks might not be accurate

- * Sources:

MILLENIUM SEED BANK PROJECT

The largest seed bank of the world Millenium Seed Bank is an international conservation project and research center, a “living library” of over 3 billion seeds, which contains visitor center, as well as residential and educational science facilities.

Project Data:
Architect: Stanton Williams.
Client: The Royal Botanic Gardens Kew
Location: Wakehurst Place, West Sussex, England.
Status: Completed 2000
Value: £14.0 m

The seed bank was formed to prevent extinction of plant species by storing their seeds and using them in future. Millennium Seed Bank has a global importance; the groups of scientists are responsible for conserving seeds from the entire world - by 2020 the seed bank plans to have species of flora representing 25% of global plant types. They study genetic information of species, take care of their germination tests of every sample in every 10 years, reproduce seeds and send back to their native lands to restore the natural habitat. The building is an interesting hybrid of public and private facilities: offices for scientists are mixed with public exhibition spaces, so that visitors could see how important plant studies are and be inspired by the research process. There are also completely isolated, underground zones with constant temperature and humidity level and the climate control is done very energy efficiently. I believe that studying that building will help me understand the process of plant conservation, spatial and technical needs and public involvement level for my project.

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PUBLIC - Exhibition Hall

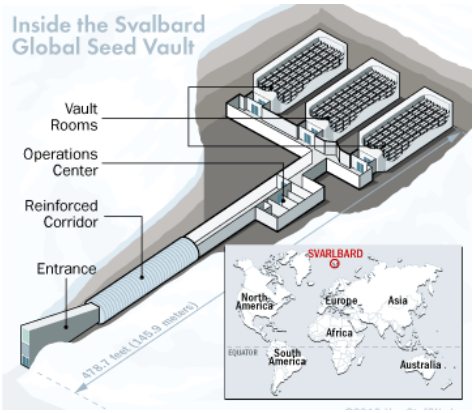
PRIVATE - Labs

Glass House

Storages

SVALBARD GLOBAL SEED VAULT

Svalbard Global Seed Vault is an underground “backup system” for the world agriculture located about 810 miles from the North Pole. The location allows scientists freeze seeds without mechanical assistance.



Project Data:
Architect: Peter W.Søderman
Client: The Global Crop Diversity Trust (GCDT)
Location: Longyearbyen, Svalbard, Norway
Status: Completed 2009

Seed banks located around the world are vulnerable due to construction, economical, mechanical or political reasons. Scientists decided to find a safe place on the world, remote from political interests, where they could conserve and preserve different crops’ species without mechanical systems, so they chose Svalbard Island – the furthest undisturbed and uninhabited place which is still easy to reach by plane.
Although this precedent was built purely for ecological reasons and has no public functions, I chose Svalbard Seed Vault because it is interesting for its natural processes and global politics. I also want to explore its storing strategies

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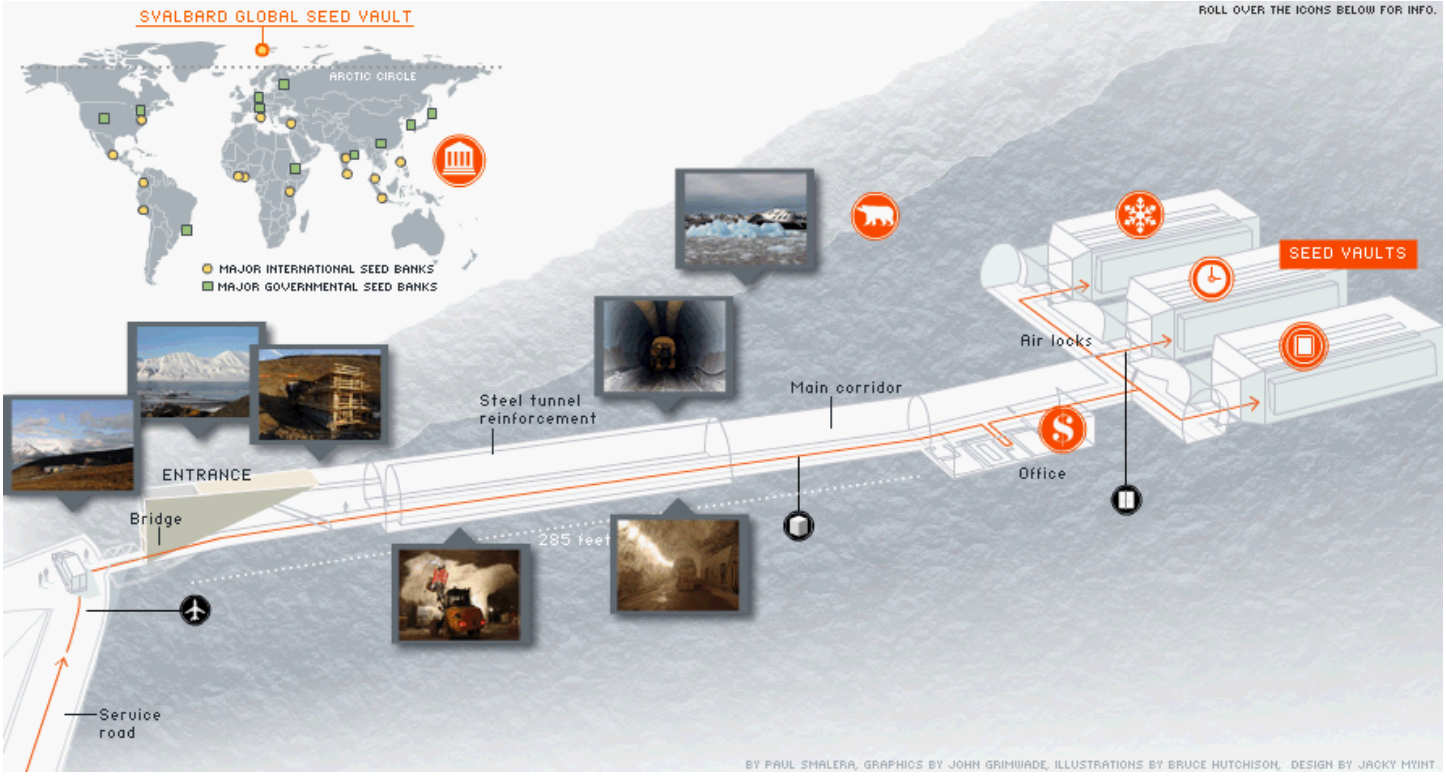

Path to Storages

Storages

EDEN PROJECT

The largest plant enclosure, the Eden Project is a significant and innovative project for its structural solution, consisting of 8 inter-linked geodesic domes.

Project Data:
Architect: Nicholas Grimshaw.
Engineer: Anthony Hunt and Associets
Project Manager: Davis Langdon
Constructor: Alfred McAlpine
Biome Design and Construction: MERO
Client: The Eden Project LTD
Location: Cornwall, England.
Status: Completed 2001
Area: 23,000 m2
Budget: £57-£75 m

The greenhouse, the shape of which is a beautiful biomimicry of inter-linked soap bubbles, is a home of thousands of species. Innovative use of thermoplastic ETFE allowed the engineers create biomes shaped with very light hexagonal panels, which can span much bigger than glass panels. I would like to research the project's mechanical and structural novelties and advanced technologies for the green house I plan to design for a prototype seed bank.

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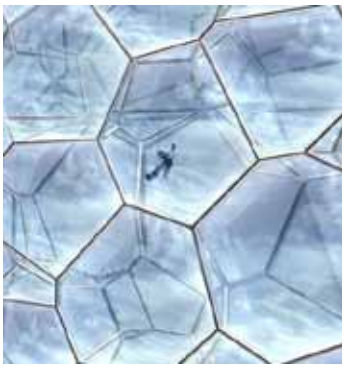
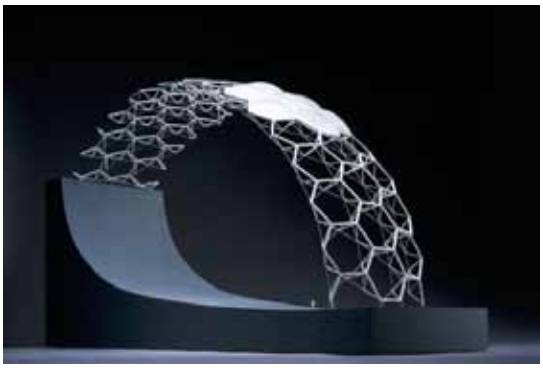
Geodesic Domes



Structure



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THE SEED CATHEDRAL

UK pavilion at Shanghai Expo is a beautiful representation of British long traditions of botanical gardens.

Project Data:
Architect: Heatherwick Studio
Client: Government of UK
Location: Shanghai, China
Status: Completed 2010
Area: 1500 m2
Budget: £25 m

Significance of this project is in a different approach to plant presentation – in place of building a greenhouse, Heatherwick studio took seeds to define plants, to highlight how unique and beautiful the beginning of each plant can look like and turned seeds into the jewelry of the pavilion. I would like to research the pavilion as a successful and poetic example of plant exhibition.

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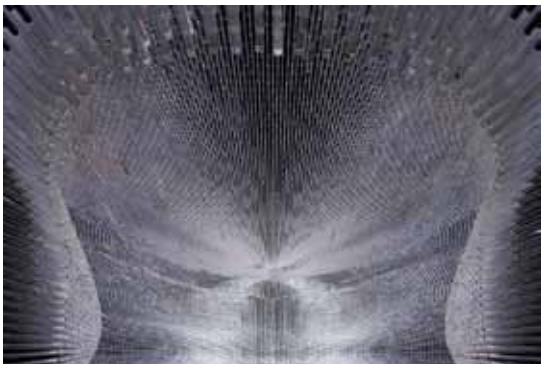
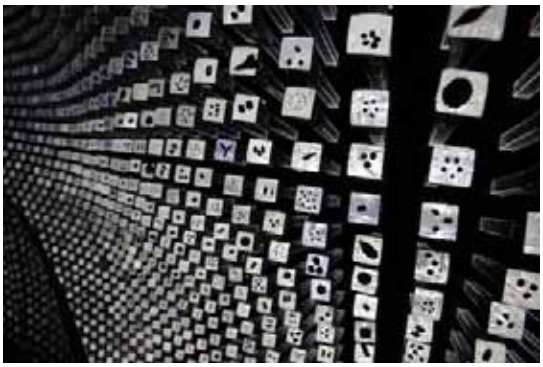
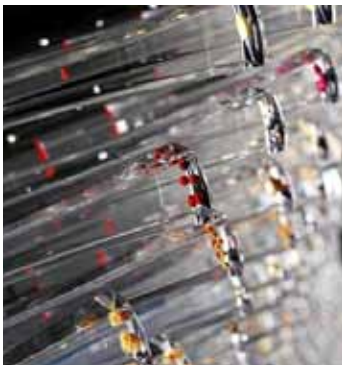
Interior



Fiber optic rods with seeds





EDF ARCHIVES CENTER

Simple and elegant archive building in France can store 70 kilometers of shelves for paper-based and microfilm-based archived material providing maximum fire protection and constant temperature and humidity.

Project Data:
Architect: LAN Architecture
Client: EDF
Project Manager: Christophe Leblond
Location: Bure-Saurdon, France
Competition: 2008
Status: Completed 2011
Area: 6,800 m2

The reason why I got interested in the case is the storing strategies the architects chose – archives are composed by 20 similar store-houses on 5 floors; the design team worked on different floor heights to get the maximum out of the minimum amount of the built-up area. I would like to research how they hybridized storage spaces with offices, and study their plans and section drawings, as well as mechanical and fire protection systems.

REFERENCES

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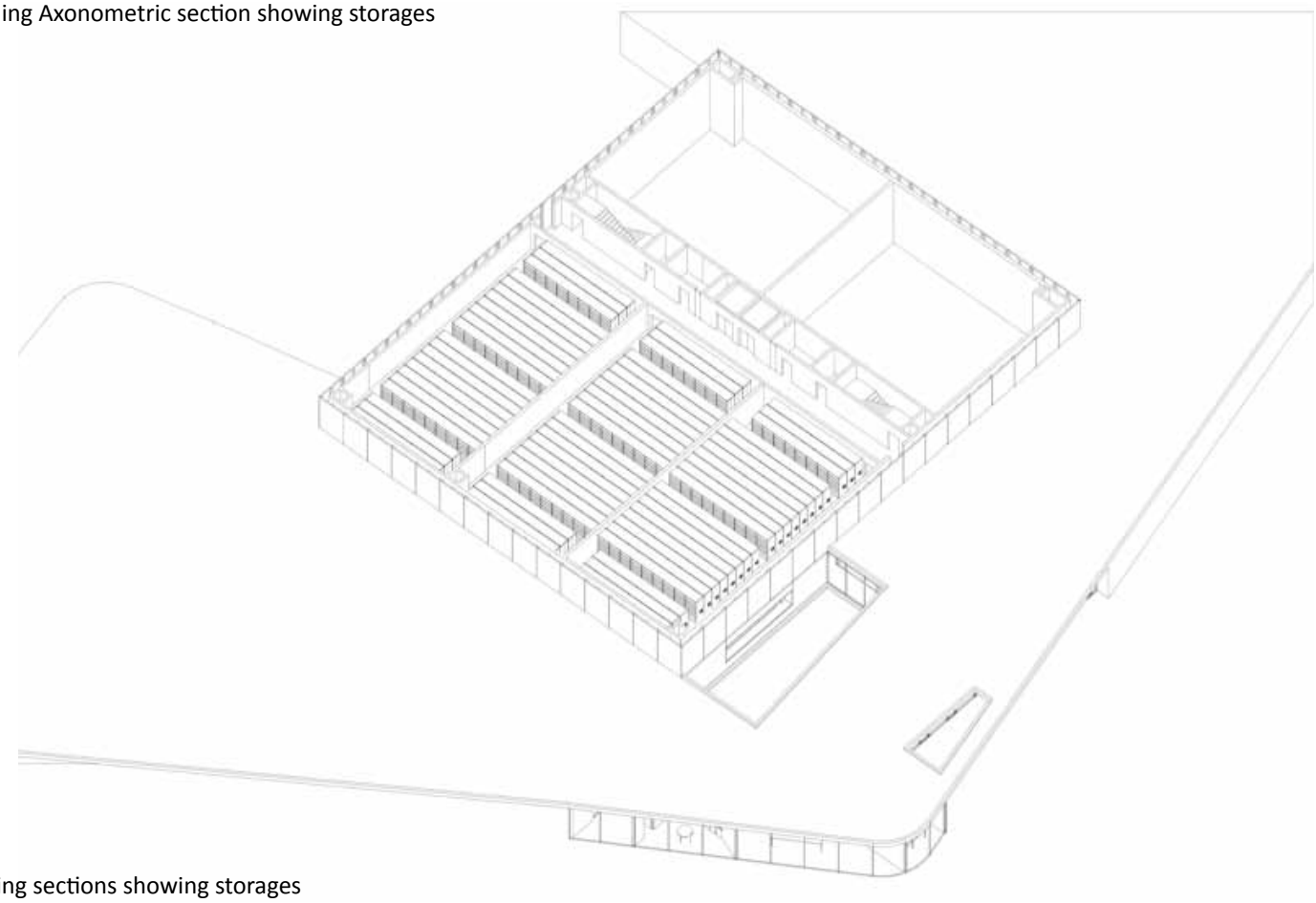
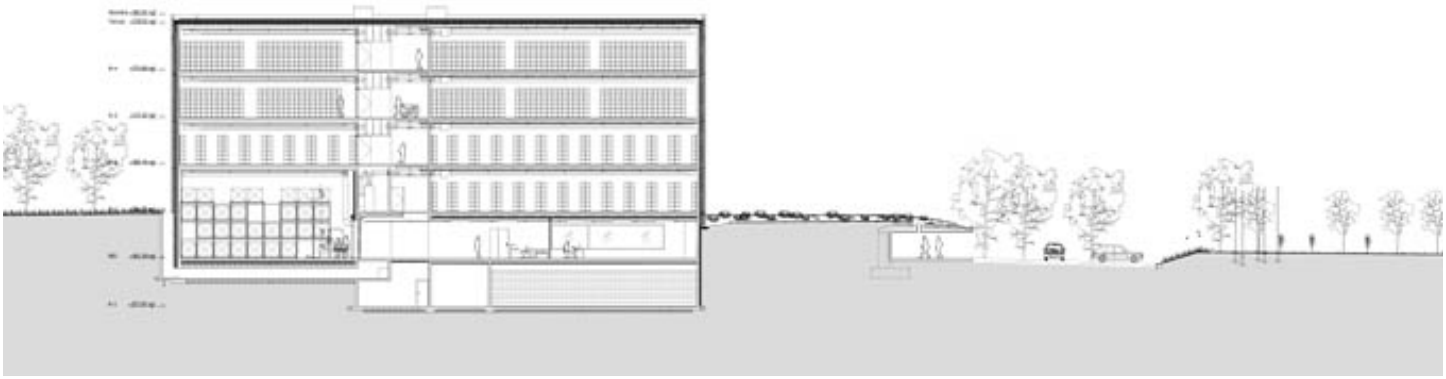
Buillding Axonometric section showing storages



Building sections showing storages



INSTITUTE OF THE BOTANICAL GARDEN OF BARCELONA

Short Desctiption

Project Data:

Case Statement

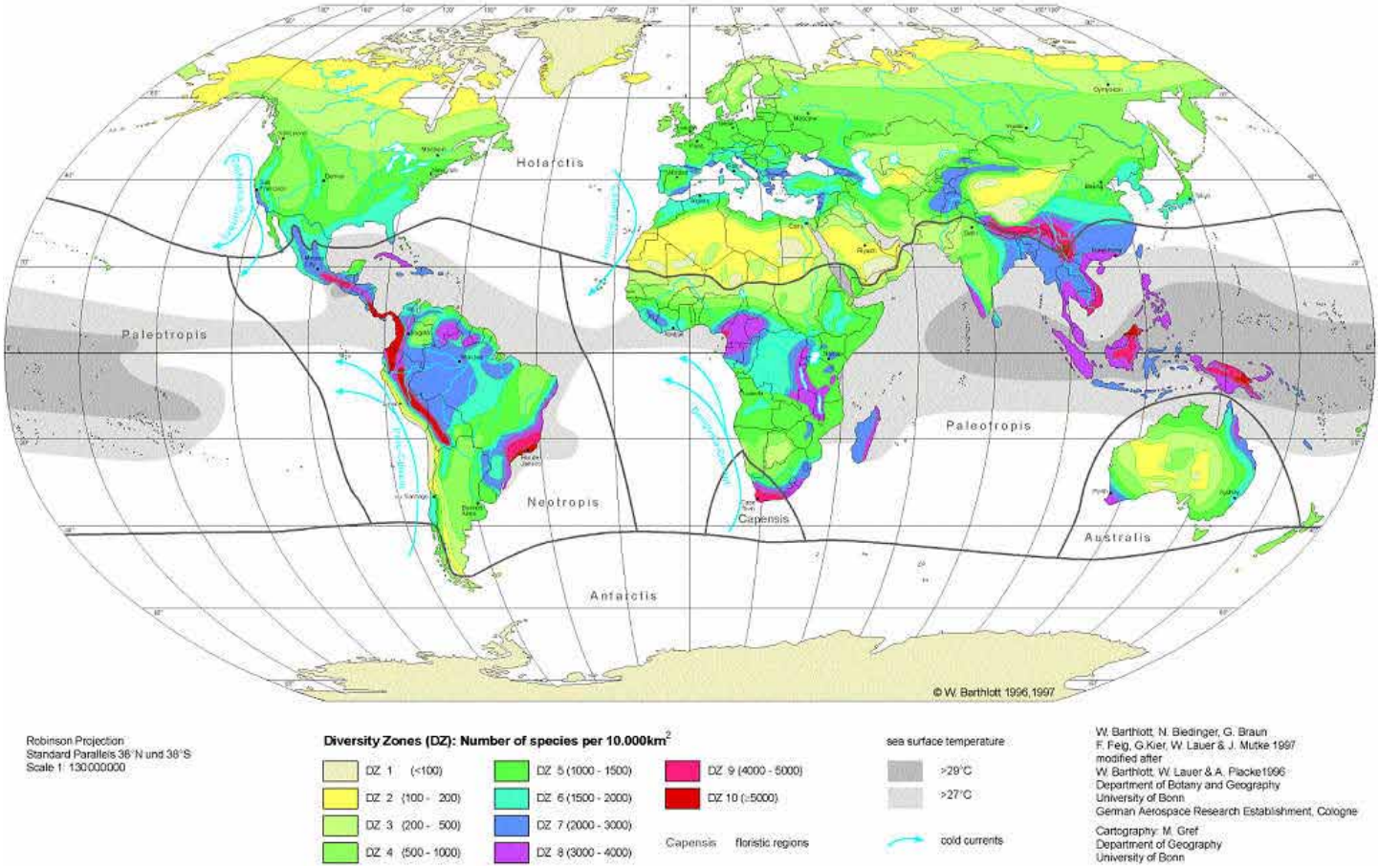
REFERENCES

* Pictures and program diagrams go here

Seed banks will be located in almost every country. I want to create a network of centers and sub-centers; centers will contain seed storages, labs and educational facilities, as well as temporary accommodation. As for the sub-centers, they will contain storages and/or green houses only.
The locations for centers and sub-centers are defined by long term predictions of climate and economy. Plant hardiness zones and global warming flooding prediction also play a big role in site selection.

* Seed bank network diagram is being prepared.

GLOBAL DIVERSITY: SPECIES NUMBERS OF VASCULAR PLANTS

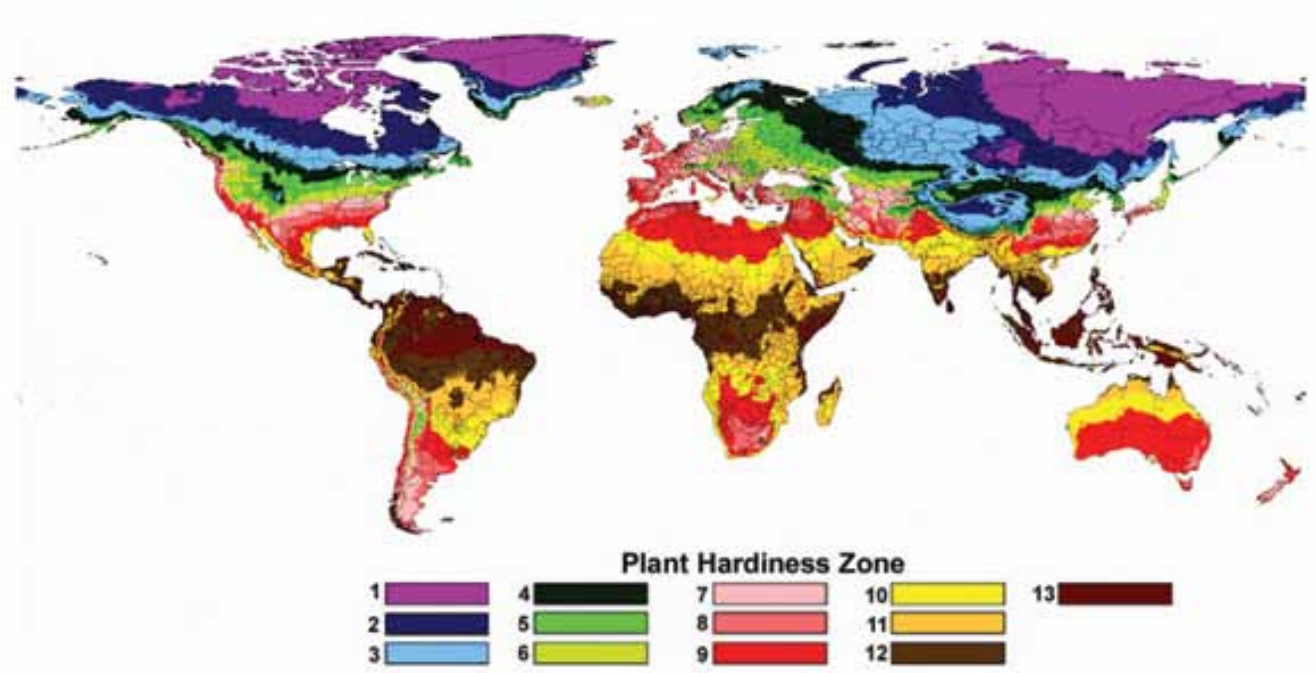


*Source: Hamburg University. Biodiversity – Number of Species and Individuals. Web. August 2006 <http://www.biologie.uni-hamburg.de/b-online/e56/56b.htm>

BIODIVERSITY HOTSPOTS

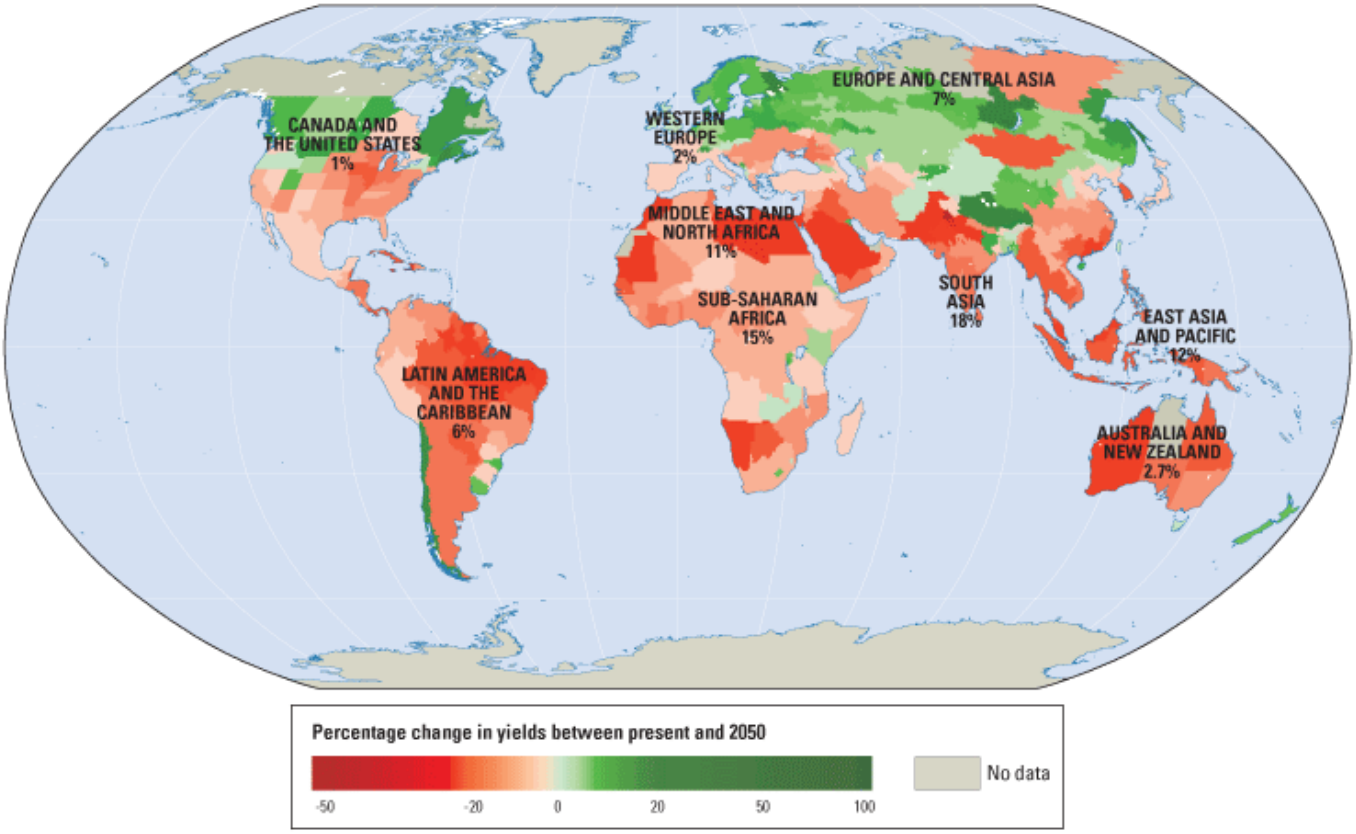
*Source: Oxford Partnership. Diversity Hotspots. Web. <http://community.priorityclub.com/t5/Oxford-Partnership/ct-p/oxford>

THIRTY-YEAR GLOBAL PLANT HARDNESS ZONE MAP FOR THE PERIOD 1978-2007



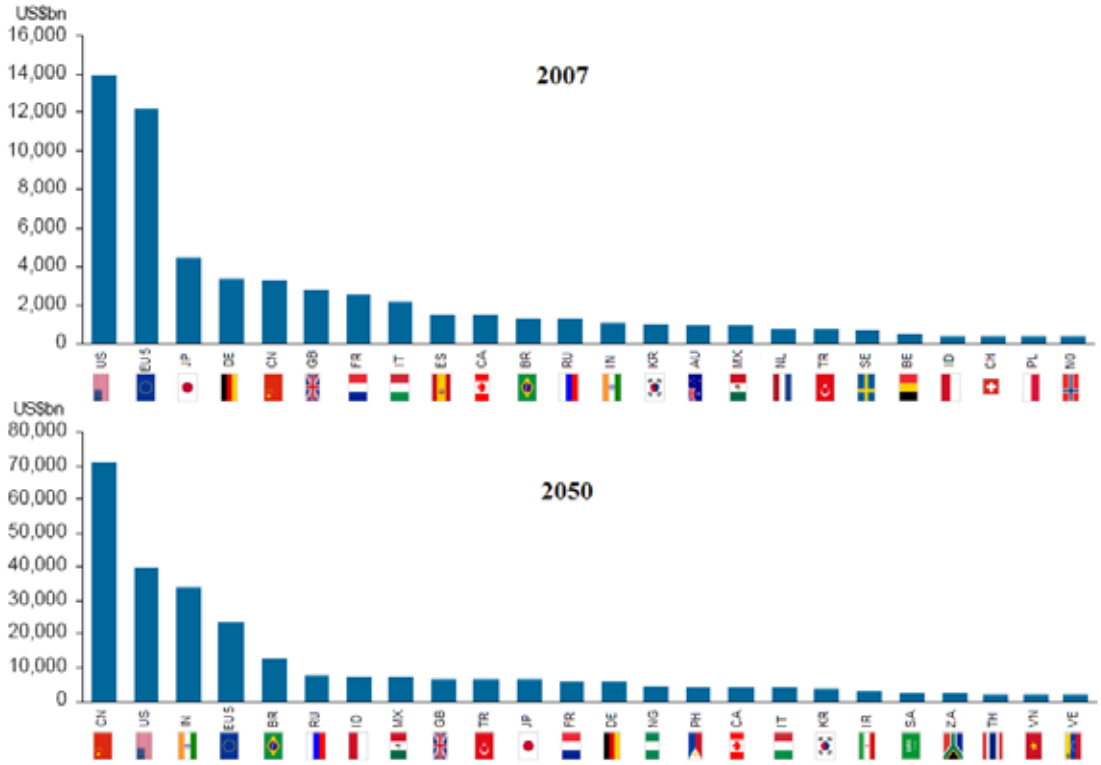
*Source: Scientia Agricola. Global plant hardiness zones for phytosanitary risk analysis. (Piracicaba, Braz.) vol.65 no.spe Piracicaba. Dec. 2008. Web. <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-90162008000700009>

CLIMATE CHANGE INFLUENCE ON AGRICULTURAL YIELDS BY 2050



Sources: Müller and others 2009; World Bank 2008c.
Note: The coloring in the figure shows the projected percentage change in yields of 11 major crops (wheat, rice, maize, millet, field pea, sugar beet, sweet potato, soybean, groundnut, sunflower, and rapeseed) from 2046 to 2055, compared with 1996–2005. The yield-change values are the mean of three emission scenarios across five global climate models, assuming no CO_2 fertilization (a possible boost to plant growth and water-use efficiency from higher ambient CO_2 concentrations). The numbers indicate the share of GDP derived from agriculture in each region. (The share for Sub-Saharan Africa is 23 percent if South Africa is excluded.) Large negative yield impacts are projected in many areas that are highly dependent on agriculture.

WORLD GDP PREDICTION CHART



*Source: Global Sherpa. BRIC Countries – Background, Latest News, Statistics and Original Articles. Web. <http://www.globalsherpa.org/bric-countries-brics>